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An Automated Systems for the Detection of Macular Ischemia based-Diabetic Retinopathy

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Abstract: *The proposed methodology in this paper marks out application for automatic detection of eye diseases called Macular Ischemia using image processing techniques. In semi urban and rural areas large percentages of people suffer from various eye diseases. For diagnoses of various eye diseases, Image processing technique is used. . Diseases occur in Macula from retinal images have a huge type of textures, shapes and at times they are difficult to be recognised and identified by doctors. Thus we are trying to optimize and develop such system which is based on smart image recognition/classification algorithms. This proposed system provides accuracy, uniformity and speed in performance and a high credence coefficient in results interpreting.*
Keywords: Macular Ischemia, diagnosis, textures, consistence
Keywords: *consistence, diagnosis ,Macular Ischemia, optimize, textures*.

I. Introduction

The Macula is a delicate and hypersensitive area responsible for high acuity vision, color vision and central vision in the central part of the human eye retina. Macular Ischemia is a process where small blood vessels close causing lack of blood supply to the macula. Macular diseases have a large variety of shapes, textures and sometimes they are difficult to be determined and recognized by expert doctors. Many researchers are working in the domain of image processing for early detection of diabetic retinopathy based Macular Ischemia. The earliest forms of diabetic retinopathy are recognized by distortion and leaking of the blood vessels in retina. Early detection of DR based Macular Ischemia is very important because it enables timely treatment that can ease the burden of the disease on the patients by a sufficient quality of vision and prevention severe loss and blindness. Our proposed technique gives information on retinal blood vessel morphology which is adjustable for normal to expected blood vessel diameters which can detect minute and tiny blood vessel abnormalities that distinguish the blood vessel and hence support for timely detection of Macular Ischemia [1]-[5].

II. Literature Review

In [6] author present an approach using neural classification method and segmentation to separate out arteries and veins. Using two-dimensional matched filters Blood vessels are segmented, which derived from Gaussian functions, first the enhancement of retinal images had done using Homomorfic filter. The Match filter is used to detect blood vessels. Here for each segment, feature vectors is used which is based on vessel profile extraction. Blood vessel was cropped a Vessel Profile Based Feature Vectors had extracted then used for neural classifier. The obtained features introduced as the vector input of a Multi-Layer Perceptron (MLP) for classification of artery/vein[6].

According to [7] a novel technique is introduced to detect true vessels from retinal images. The methodology proposed by author is a post processing step to vessel segmentation in images. The trouble introduced in finding the optimal vessel forest from a graph with constraints on the vessel tree. All vessel trees are consider while finding ideal forest; hence, the commonly approach is a severely aware of wrong vessels coupling.

In [9] to detect the retinal disorder, author proposes one candidate extraction and two preprocessing method in this literature. Based on various features like standard deviation, area, mean, entropy etc. classification of various retinal abnormality is done. For effective screening of retinal abnormalities Adaptive NeuroFuzzy Inference System (ANFIS) is an efficient tool is used which classify the retinal images as normal, mild, severe depending on their severity.

From literature [10], a graph formulation was implemented with Dijkstra's shortest path algorithm for detection of central vein. Likewise, In [11] author introduced Dijkstra's algorithm for determine vessels and calculated their proposed method on a group of 15retinal images. Although, this method is incorrect for vessel detection due to selecting proper vessel segments to meet at a branches or crossover needs information from another neighboring vessel in retina. In paper[12] author proposed expert rules to solved vessels crossover. At

these crossovers, rarely lineup segments to provide a vascular network. Although, they are failed determined complete vessels.

In literature [13] a new technique of blood-vessel identification in human retinal images, using Quad trees of edges and post-filtration of edges depends on the regional circulative hierarchical decomposition using a fixed difference operator. The blood vessels presents as blackening of blurred edges and focal, indicated by an determine intensity slope/gradient, which is distributed in rejection of false alarms to a huge intensity. This technique gives information of blood vessel morphology in retina that progress to diameter of normal expected blood vessel, which detect the neat and rare(fine) blood vessel abnormalities that identified blood vessels and thus benefit for detection of Diabetic Retinopathy.

In [14] author proposed vessel enhancement approach for evolution microneurysms filter. Microaneurysms filter detects microaneurysms and hemorrhages present in retinal images. These classification output helped to integrate different types of diagnosis with the help of various ophthalmologist.

III. Proposed Work

In this methodology, the proposed system is focusing on increasing sensitivity, specificity and the accuracy for the detection of any type of retinal disease present in the patient. The system can be used for automatic screening of Macular Ischemia with an additive capability of grading the retinal image on basis of abnormalities present in it and implementing it by using computer aided system to calculate the computational processing time[5].

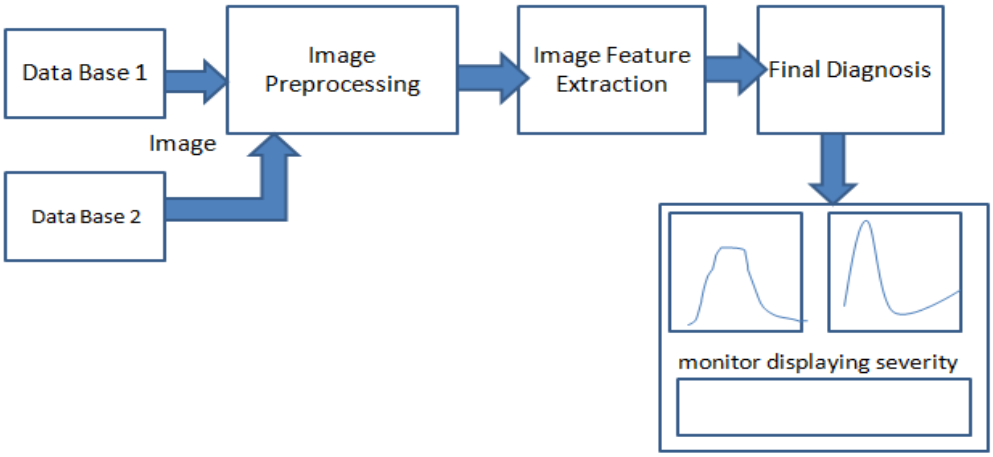

Fig 1: Proposed System Design

Retinal images acquired from database or retinal investigation camera, then two retinal images from database are compare simultaneously for comparing parameters of two images and arrange them according to severity.

The given retinal dataset images are converted into gray image by separate any one of RED, GREEN, and BLUE. Because the retinal abnormalities have better visualization in the gray scale when compared to others. Vessels are segmented in gray image using Morphological method. Normally retinal image green channel give the better performance result.

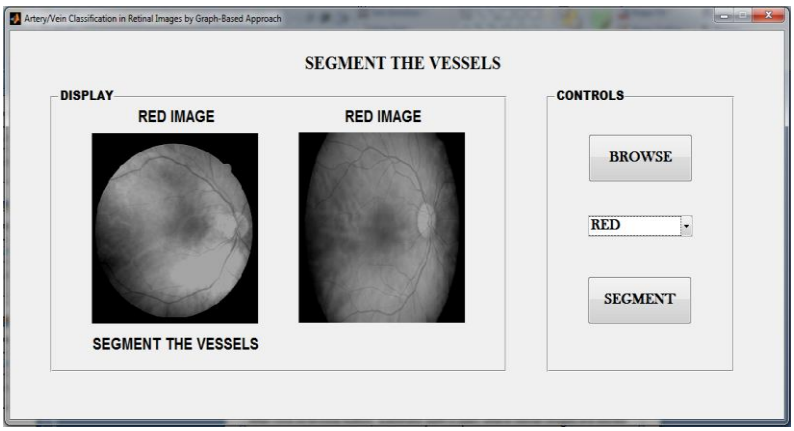

Fig 2: GUI of Grey Image conversion

Classification of vessels into arteries and veins:

As macular consist of lots of vessels, vessel extraction is done and find which are arteries and veins ones and find the standard diameter of veins (threshold diameter) along with minimum and maximum values. Then each and every vein is compared with that standard diameter and if any vein found more diameter than standard value then we consider that vein is affected by Macular Ischemia. For classification of Artery/Vein in Retinal Images here Graph-Based Approach is used. Based on Area of diseases, affected area, grading of severity will be done as healthy, mild, severe and most serious level of disease.

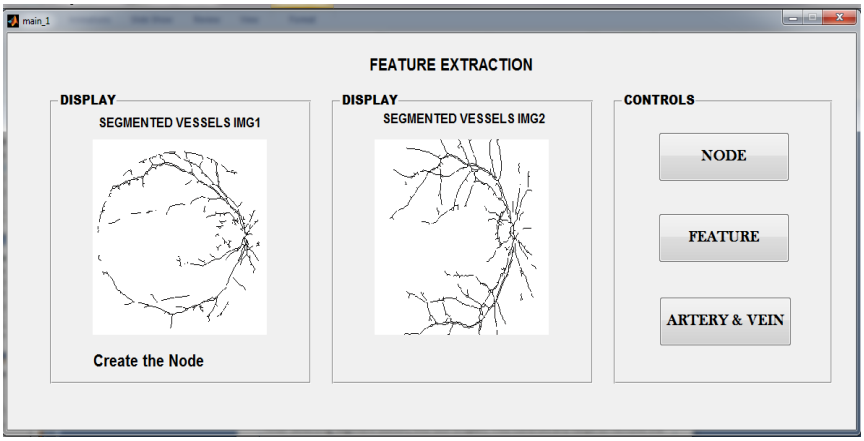

Fig 3: GUI of segmented vessels of both retinal images from 2 datasets

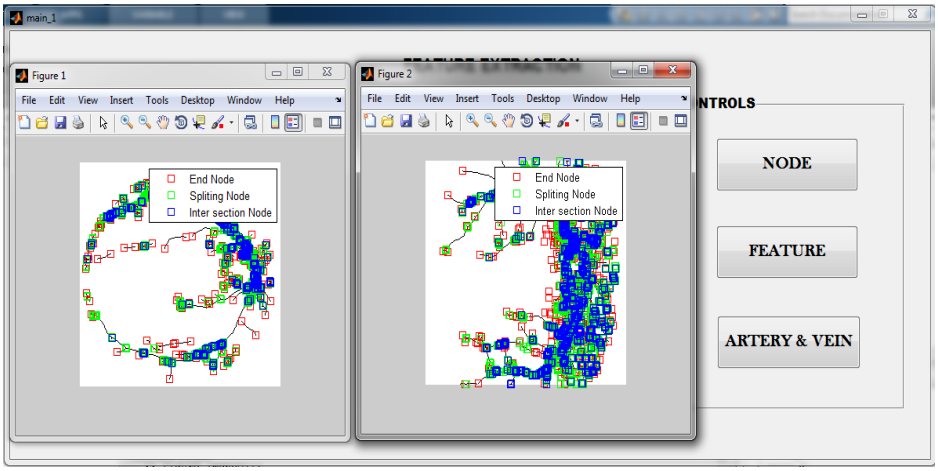

Fig 4: GUI shows classification of Nodes i.e. End Nodes, Intersection Nodes, and Splitting Nodes

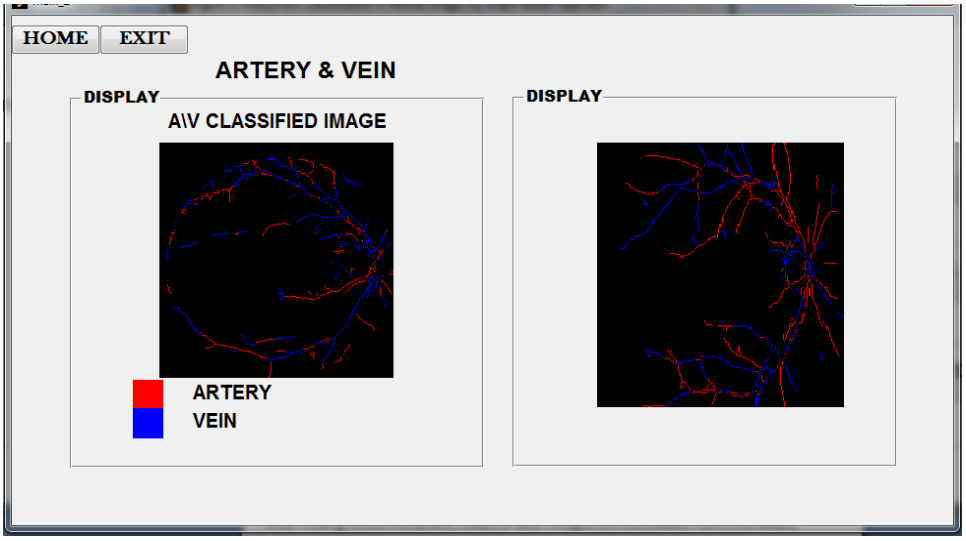

Fig 5: GUI of classification of Arteries/Veins

Classification of various stages of abnormality:

Using SVM algorithm, grading of severity is done and retinal abnormalities are classify as Normal, Moderate and Severe class depending on their severity and save each images in separate database accordingly. Images of different stages of diabetic retinopathy, which is collected from DRIVE database.

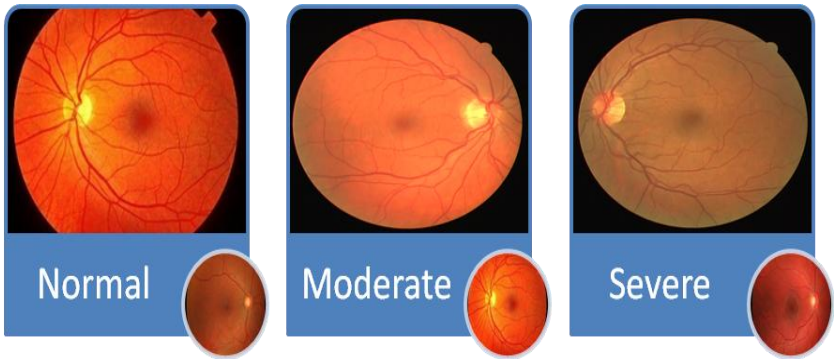

Figure 6: Images of Different Stages of DR based Mi (a) Normal Stage (b) Mild Stage (c) Severe Stage

IV. Conclusion

Design the ensemble based system using various preprocessing and feature extraction methods. Also finds the severity of the Ischemia diseases extracted from the retinal images and detect the Macular Ischemia caused by diabetes from the retinal images database by applying appropriate methodology to obtain high accuracy, sensitivity and specificity.

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